



# MISR Albedo and Cloud Height Changes

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# outline: a talk in three parts

- SW and LW time series from MISR
  - 13 years, and counting
- sampling artifacts
  - present and absent
- comparisons with CERES-Terra

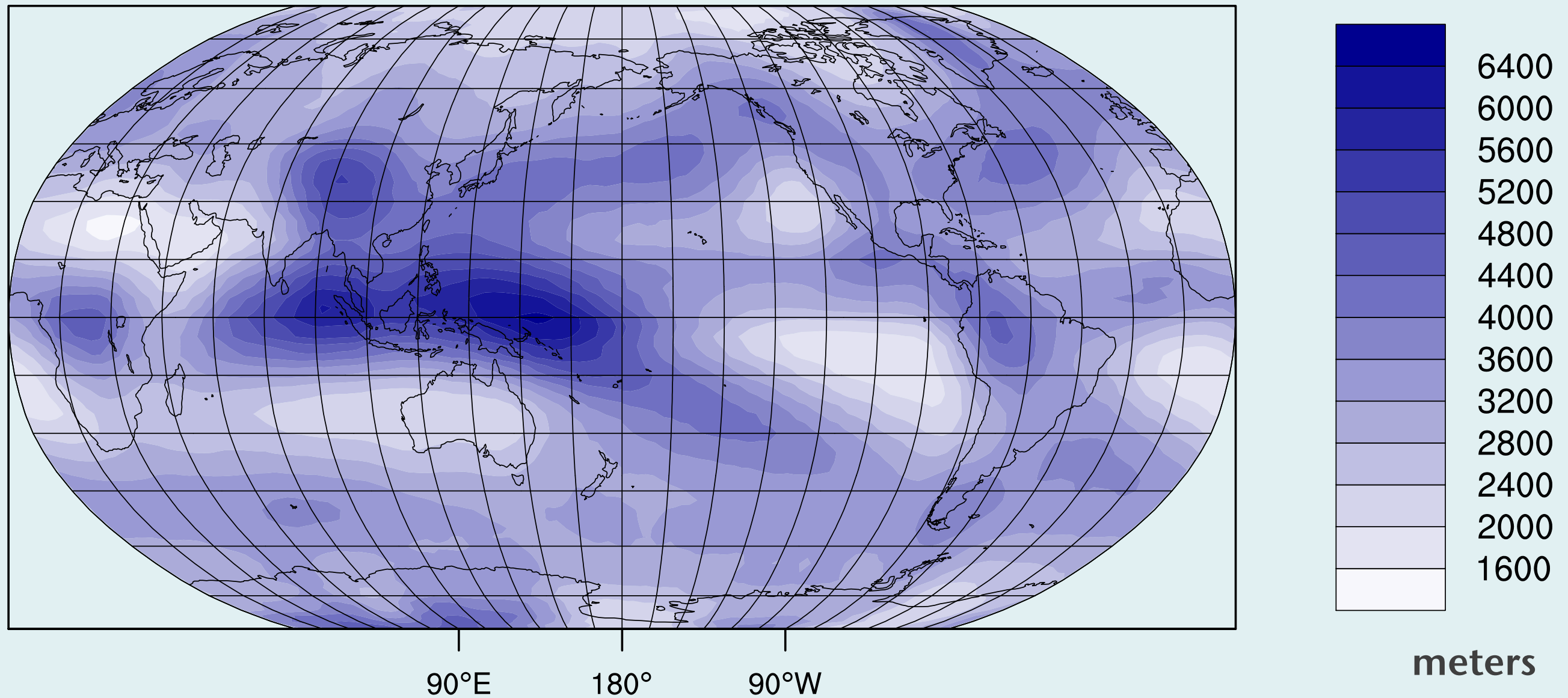
# Terra climate data records

- MISR stereo heights
  - self-consistent: 3/2000 – present
  - $O(10^8)$  samples per month
  - 2.2 km horizontal resolution
  - 500 m (rms) vertical resolution
  - global sampling error:
    - $\approx 30$  m/month
    - $\approx 7$  m/year
    - geometrically derived
    - no calibration drift
- MISR multiangle albedos
  - TOA expansive albedo
  - $O(10^5)$  samples per month
  - 35 km horizontal resolution
  - global sampling error:
    - $\approx 0.002$ /month
    - $\approx 0.0005$ /year
    - on-board calibration stable to 1% over mission lifetime
- CERES LW and SW daytime flux
  - $1^\circ$  daily global sampling error
    - $\approx 0.3 \text{ W m}^{-2}$ /month
    - $< 0.1 \text{ W m}^{-2}$ /year

**progressively more and more valuable with time**

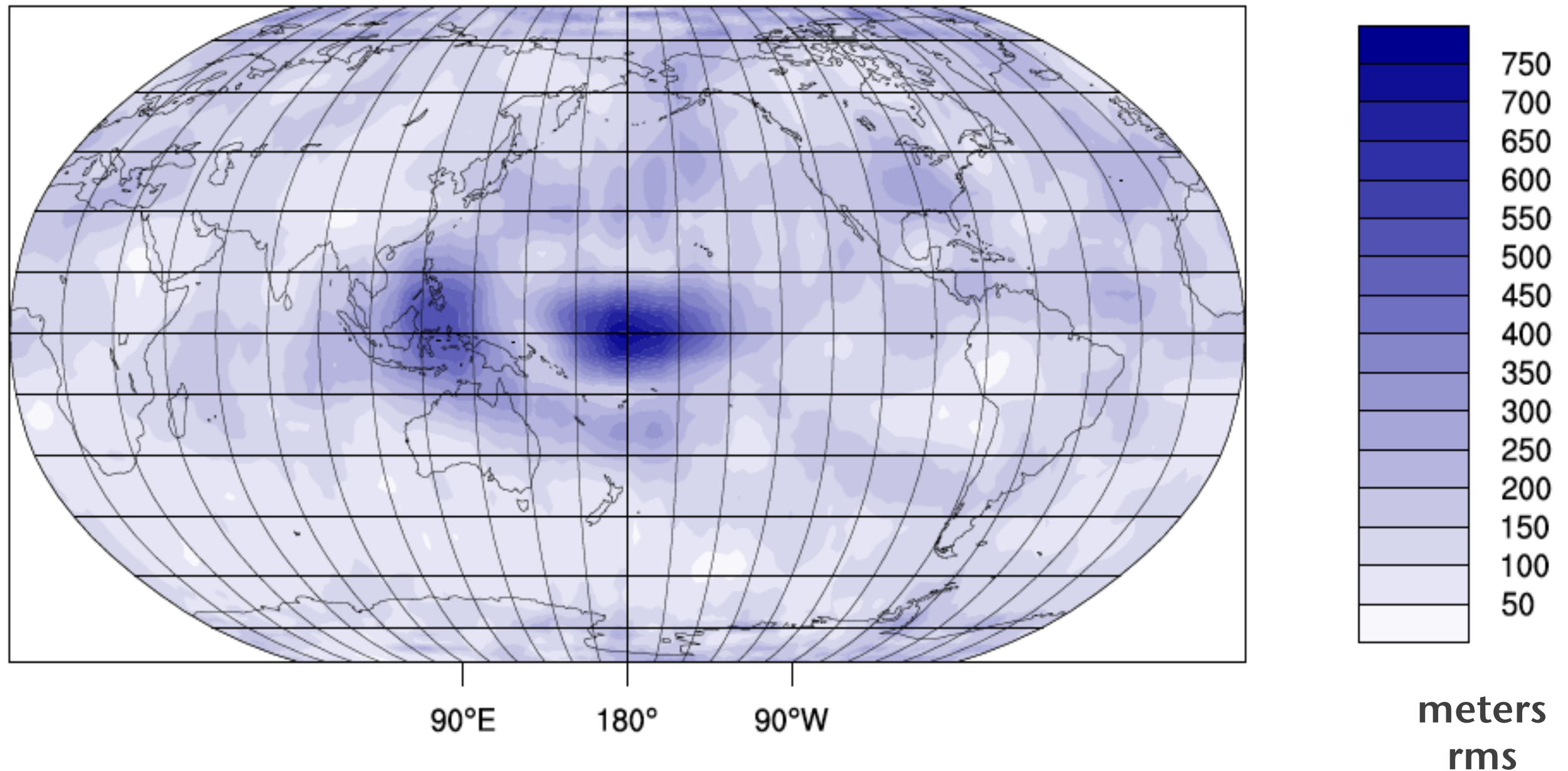
# Annual Mean Effective Height from MISR

$$H = \int f(h)h dh$$



March 2000 — February 2010: *the first 10 years*

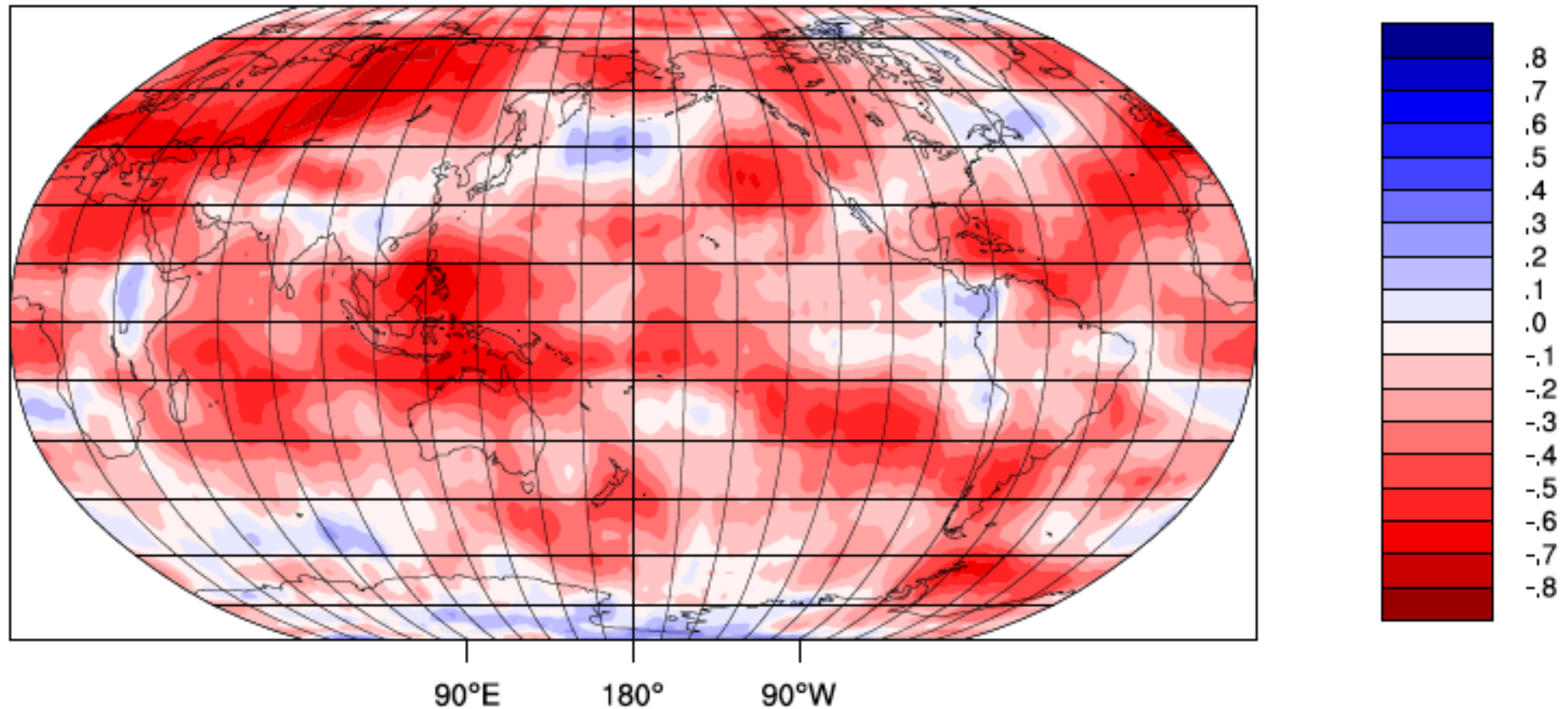
# Interannual Fluctuation of Effective Height



$$H' = H - \langle H \rangle$$



# Correlation of anomalies in cloud-top height with anomalies in sea level pressure



sea level pressure from NCEP reanalysis

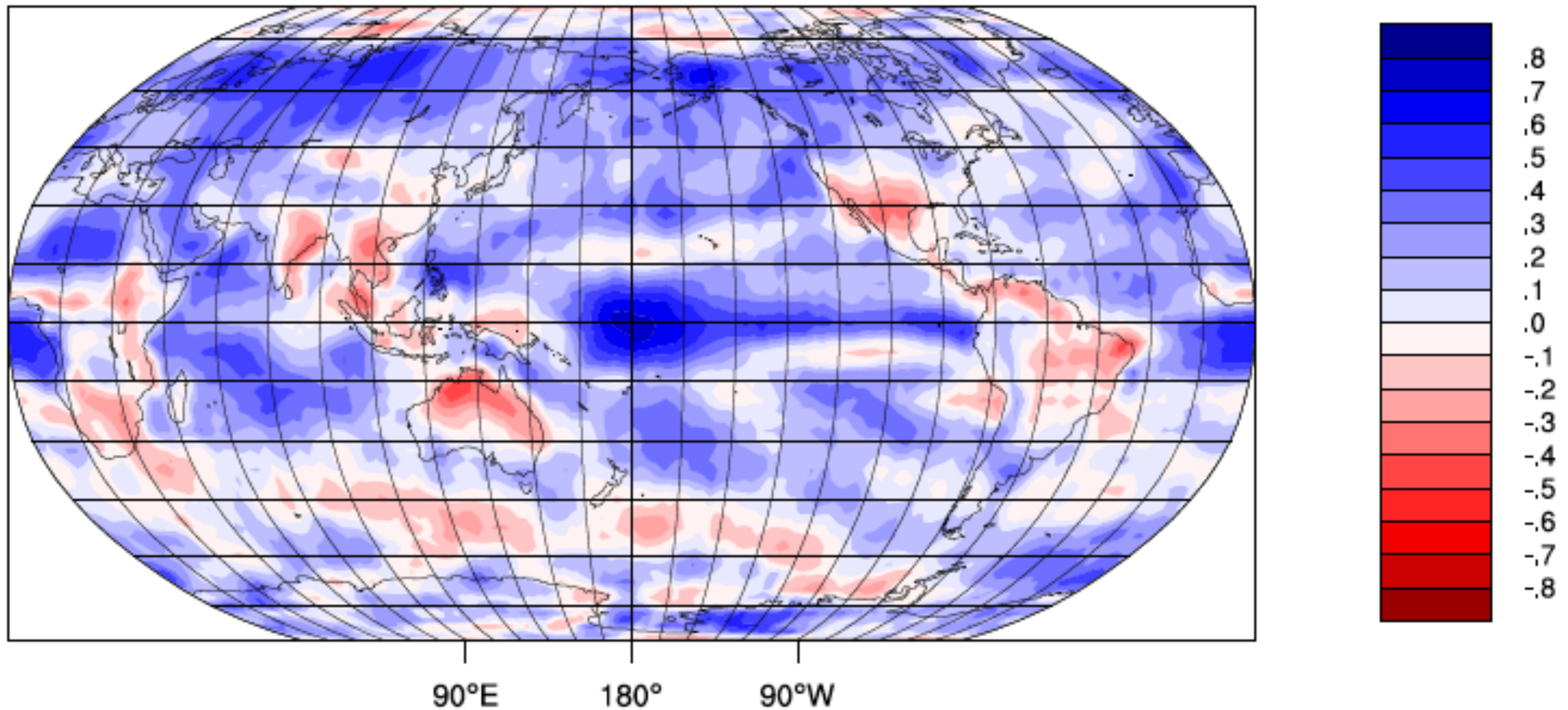
cloud-top heights from MISR

Mar 2000–Feb 2010

8/5/2013

CERES Science Team Meeting

# Correlation of anomalies in cloud-top height with anomalies in surface temperature



surface temperature from NCEP reanalysis

cloud-top heights from MISR

Mar 2000–Feb 2010

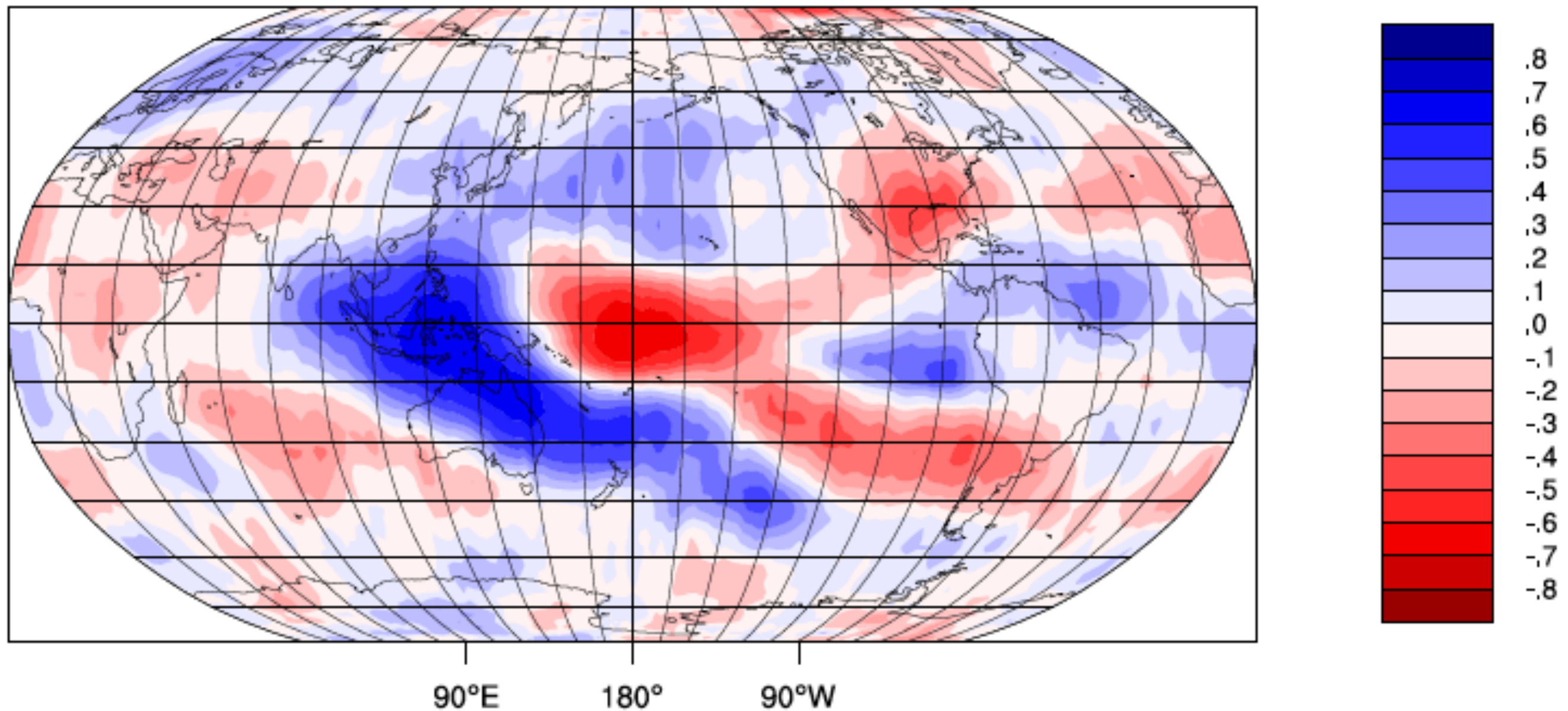
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# Correlation of anomalies in cloud-top height with anomalies in Southern Oscillation Index

$H'$  correlated with SOI



SOI from Australian Bureau of Meteorology

cloud-top heights from MISR

8/5/2013

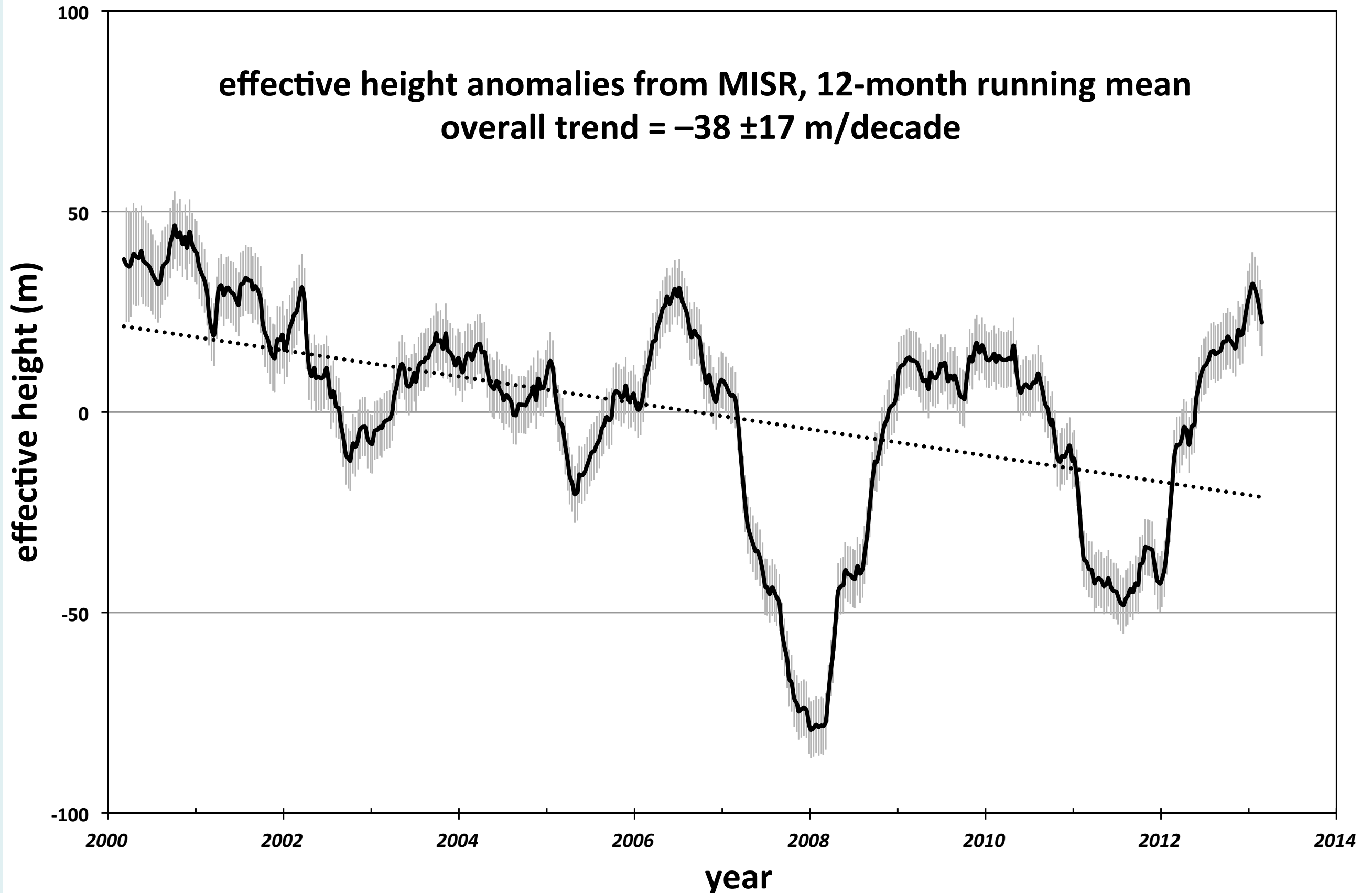
Mar 2000–Feb 2010

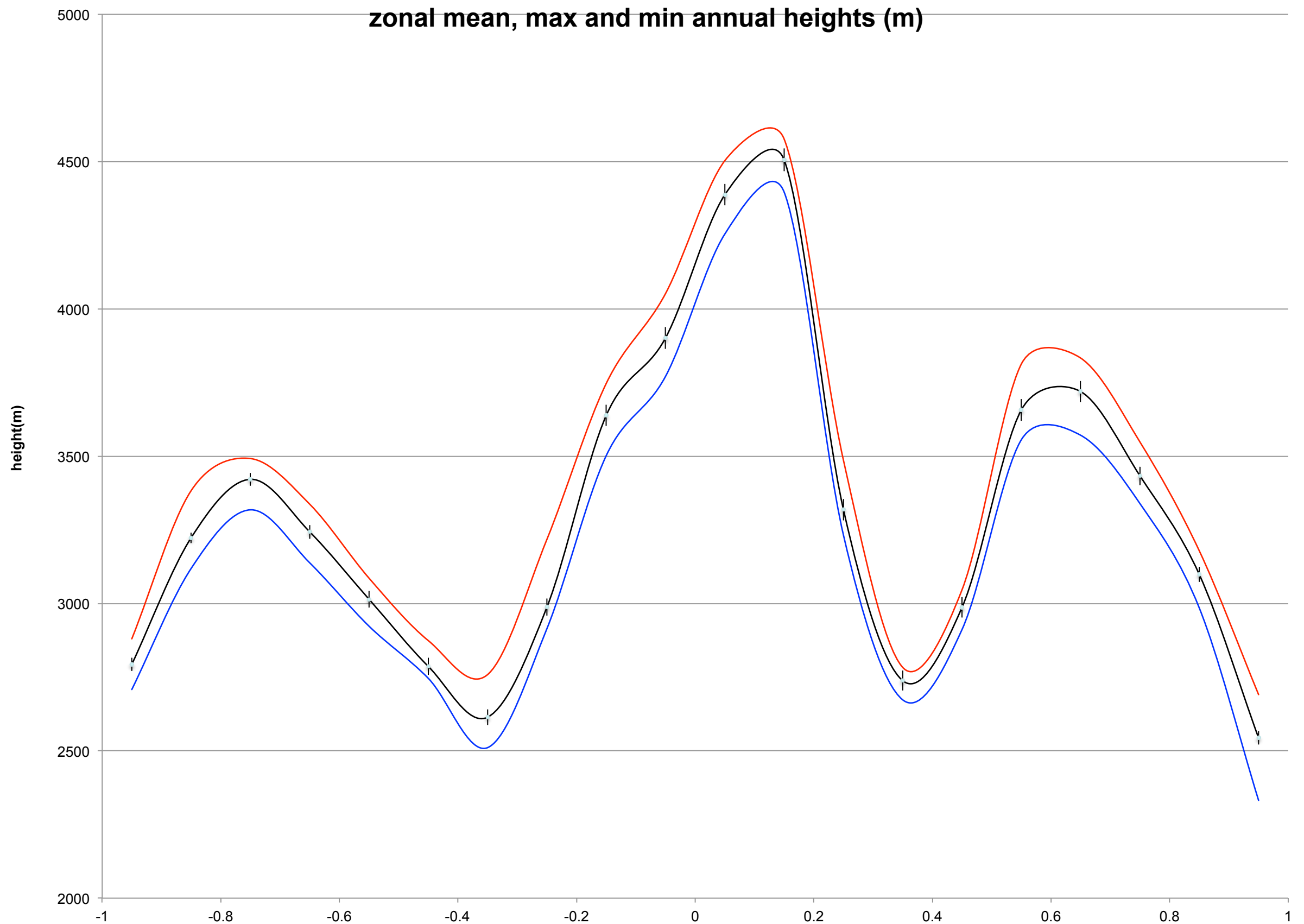
Davies and Molloy, GRL 2012

CERES Science Team Meeting

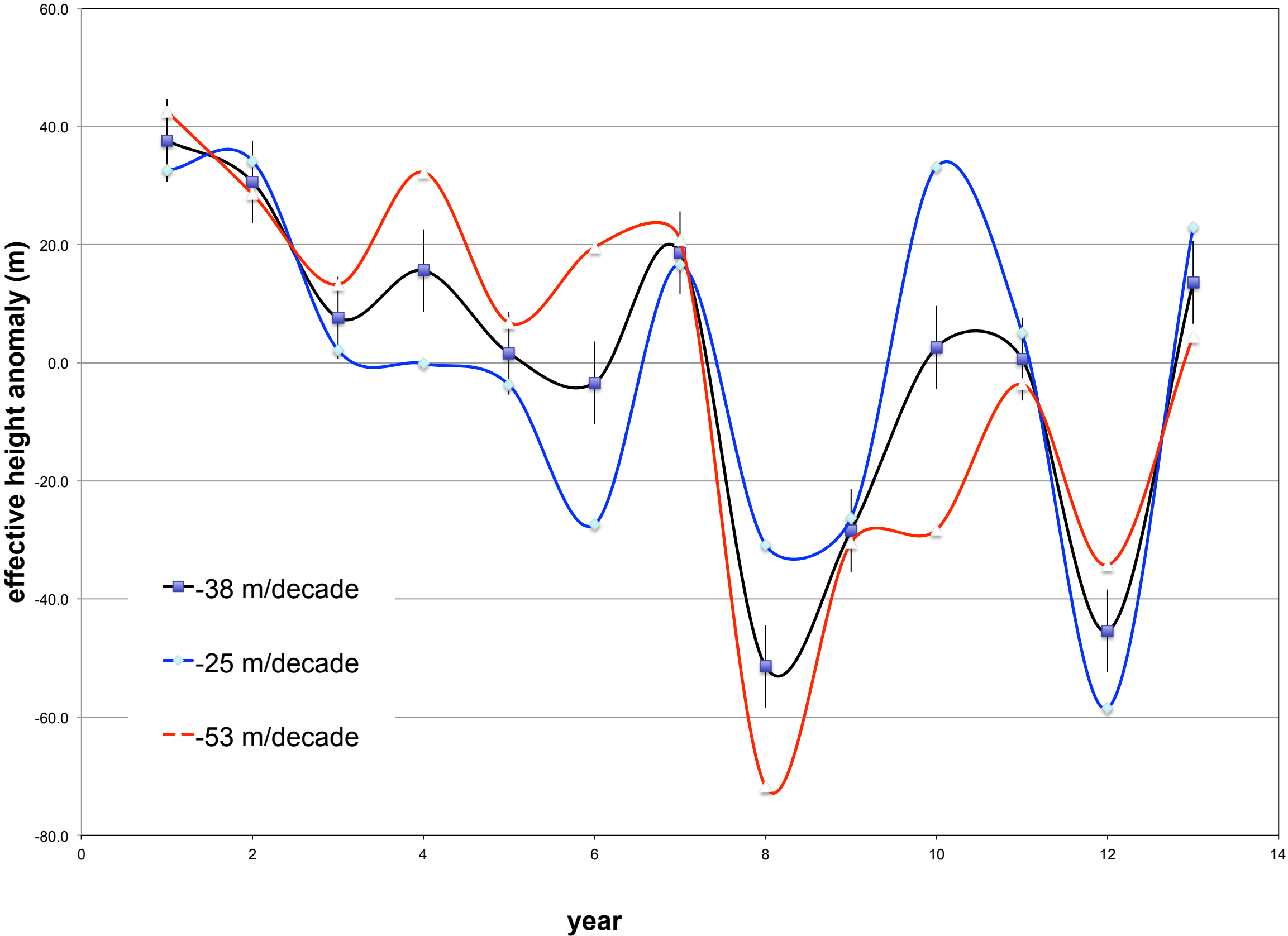


**effective height anomalies from MISR, 12-month running mean  
overall trend =  $-38 \pm 17$  m/decade**

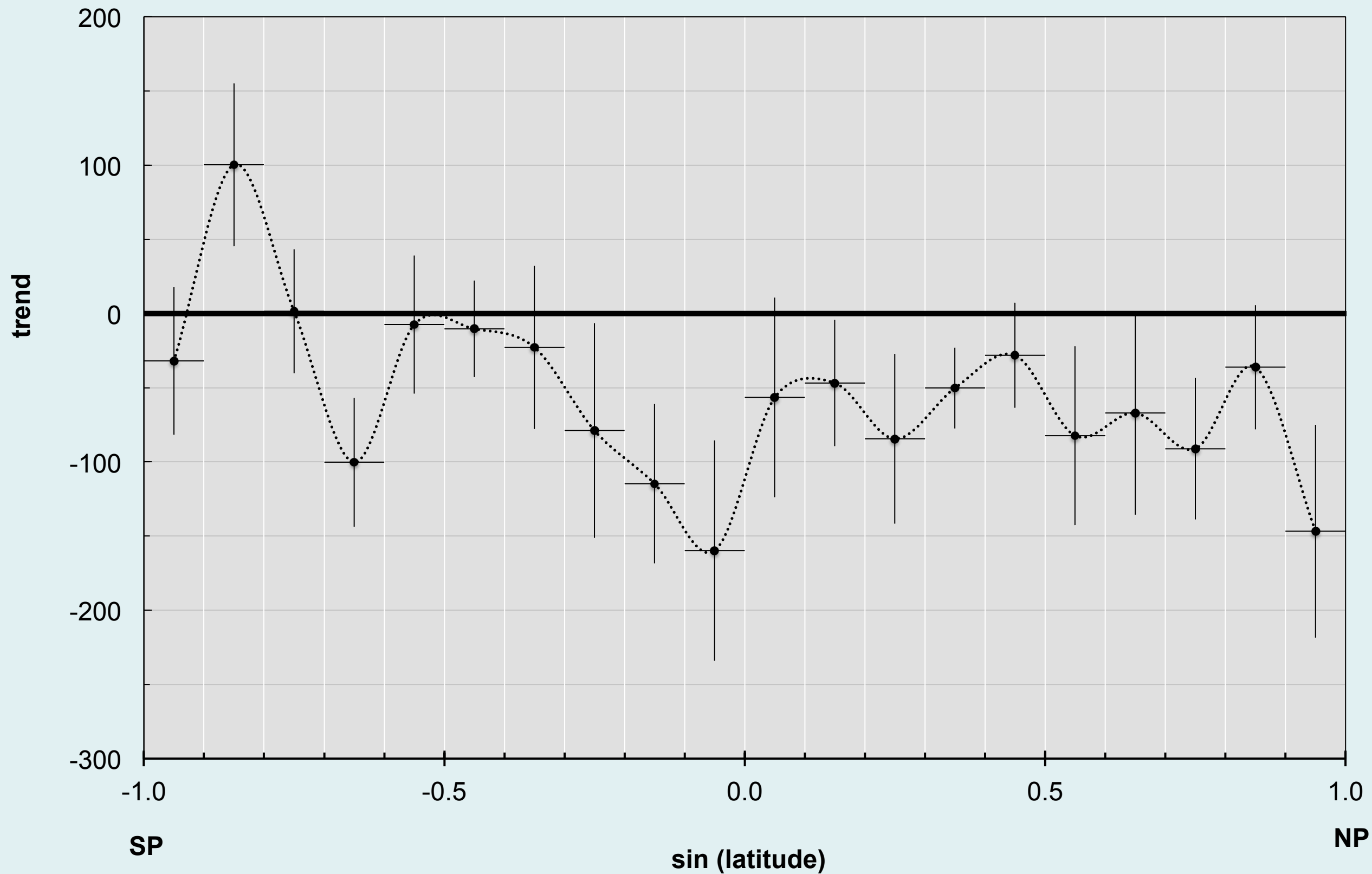




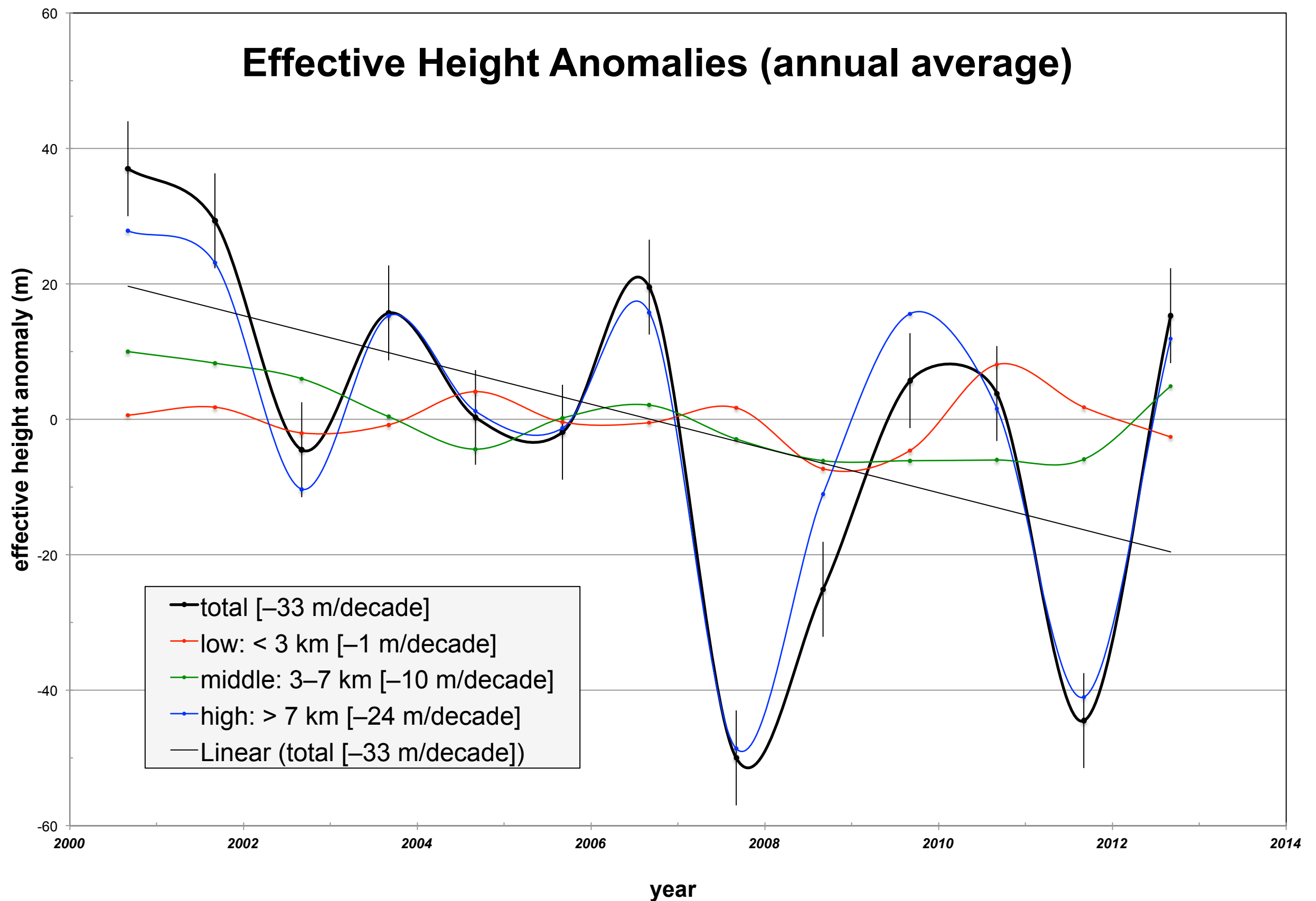
global, S hemisphere, N hemisphere



decadal trends in zonal effective height 2000–2012 (m/decade)



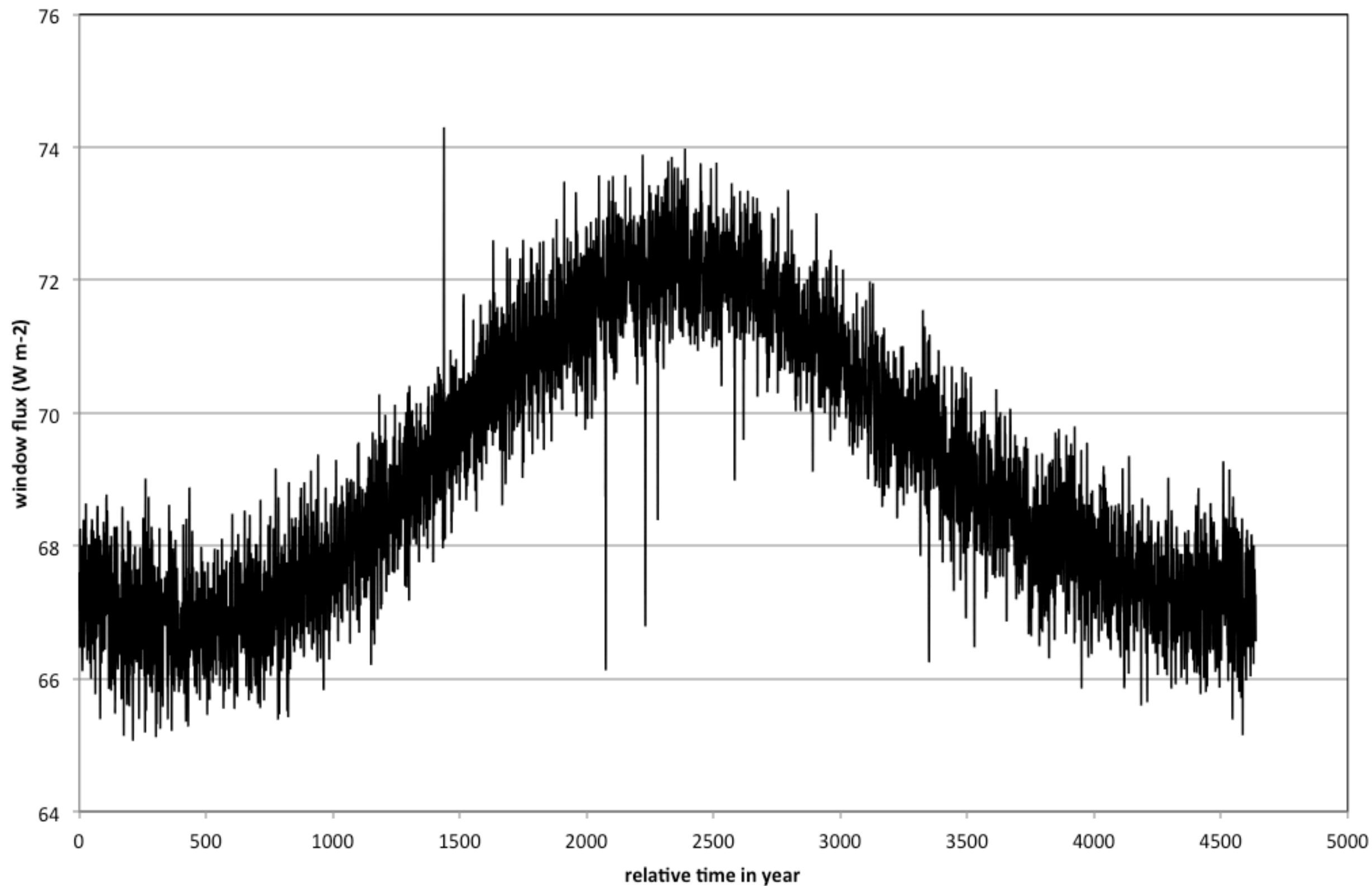




# what can we learn from CERES?

- Terra window fluxes
  - daytime only, viewing zenith within  $\pm 25^\circ$  to match MISR

# global





# what about albedos?

- MISR measures spectral radiances only
  - 9-angle integration
  - still need angular model for azimuthal fill
  - green band, local time anomalies





# summary

- global annual sampling by MISR and CERES is much better than the observed interannual variability
- the first two years of Terra had issues with spacecraft attitude and ephemeris that may affect the time series
- MISR: global effective height (especially low lat) and global albedo (high N lat) have decreased slightly during 13 years.
- next step: examine zonal differences and resolve CERES/MISR differences



*thank you*